

Berthelot, Lord Rayleigh, Leduc, Guye and his co-workers, from the study of gases have been able by a nice combination of exact theory and experiment to bring independent evidence as to the molecular weight of gases; at the same time, Morley, T. W. Richards, and others at Harvard have considerably increased the accuracy with which the more important atomic, or rather combining, weights are known. Prof. Young's own researches have been closely related to the former investigations.

The problem in the deduction of accurate atomic and molecular weights from the properties of gases is the precise application of Avogadro's hypothesis; that is, it is necessary to know the relative volumes (at 0° and one atmosphere) of the gas under consideration and oxygen, which contain equal numbers of molecules. When these volumes are known, the weight of the molecule of the gas can be found at once from its density relative to that of oxygen. Berthelot assumes that Avogadro's hypothesis is strictly true when gases are at small pressures; to apply this assumption, p_v has been observed at a small pressure and at one atmosphere for several gases, including oxygen. Guye uses the principle of corresponding states; for example, argon and oxygen have approximately the same critical pressure and temperature, so he assumes that equal volumes of these two gases (at 0° and one atmosphere) have the same number of molecules; and finally, the values of a and b in van der Waals's equation have been used directly to find the Avogadro volumes. The atomic weight of nitrogen obtained in this way is 14.01, as opposed to the formerly accepted 14.04; there is plenty of evidence that the smaller value is the more accurate one.

As was to be expected, the treatment of change of state, van der Waals's theory, the vaporisation of mixed liquids, &c. (where so much of the best work is that of Prof. Young himself), is at once clear, precise, and interesting.

The first chapter, of twelve pages, on "The Fundamental Laws of Chemical Combination," which also includes Dalton's atomic theory, seems to us entirely unsatisfactory, and falls much below the standard of the rest of the book. These fundamental subjects receive the usual inadequate treatment which mars so many elementary text-books of chemistry. The definition of an element, as a substance not decomposable *at will*, is artificial, and merely avoids the difficulties raised by the well-verified spontaneous change of radium into helium. Our complaint, however, is with the presentment of the laws of chemical combination. When a generalisation is raised to the dignity of being called a law, surely the value of science as a method of thought demands, (1) the definition of the law in clear and precise language, (2) a statement of the observations (with their accuracy) upon which the law is based? None of these is done for the law of definite proportions. It is high time the "law" of multiple proportions was omitted from text-books. The statement of it criticised ends with the words "vary in the different compounds according to very simple numerical proportions." Consider $C_{60}H_{122}$ and C_8H_{14} (i.e. $C_{60}H_{105}$); can the ratio 122:105 be called "very simple

numerically"? Few pairs of compounds obey the "law." Though Dalton's atomic theory was only accepted by chemists generally after half a century of controversy, and is at present rejected by a few, in the two pages devoted to it in "Stoichiometry" the difficulties of the theory are not even mentioned. It is to be hoped that these blemishes may be removed in a future edition from a book which gives such an up-to-date and adequate account of a large part of physical chemistry, and is one of the volumes most needed of a valuable series. T. H. L.

NEWTON'S PHILOSOPHY.

La Philosophie de Newton. By Dr. Léon Bloch. Pp. 642. (Paris: F. Alcan, 1908.) Price 10 francs.

THE subject of this book is Newton's "philosophy" in the large sense in which Newton himself understood that word, not in the narrower sense which is now usual. The author passes in review practically the whole of Newton's contributions to science, giving in each case their antecedents, their method, and their outcome. His historical accounts of previous discoveries, with the consequent estimates of Newton's contribution, are usually excellent, and in his exposition of Newton's ideas he is in general very faithful to his original.

M. Bloch's successive chapters, dealing with different parts of Newton's work, have a certain similarity of structure. They generally begin with Descartes, and show the element of arbitrary hypothesis in his views. Then, after some account of intermediate writers, they point out how Newton proceeded by the right inductive methods, collecting his laws and definitions from facts, and verifying their consequences by experiments. The hypotheses which he objected to, it is said, were not hypotheses used as such, but hypotheses used as though they were known to be true. It was still customary to object to a new theory, based on observation and experiment, not that it failed to explain the facts, but that it contradicted the maxims of the illustrious So-and-So. This attitude seems strange to us, because it has so completely died out in science. But it still survives in philosophy, where emphatic assertion is one of the accepted methods of proof; and from this analogy we can understand Newton's attitude and the progress it involved. M. Bloch's scheme involves some unnecessary repetitions, and one gets a little tired of the merits of induction. But substantially what he says on this subject seems just. While attributing to Bacon a great influence in forming Newton's ideas of method, he explains the two respects in which Newton surpassed Bacon's precepts, namely, that his methods were quantitative, and that he realised the part which deduction plays in induction.

Where the book is least satisfactory is on the side of logical analysis. Thus in regard to fluxions, he points out, very justly, how Newton conceived a fluxion physically, and how he often inferred the existence of limits, in problems where his mathematical apparatus was insufficient to prove it, from the fact that he was dealing with physical problems which

must have definite solutions. But M. Bloch does not adequately discuss the postulates involved, or consider how, from a modern point of view, one could justify practically a procedure such as Newton's. He seems more or less unaware of the gulf which nowadays separates the pure mathematician's account of the calculus from the physicist's use of it, and therefore cannot deal thoroughly with the very interesting question as to how this gulf is to be bridged. To take another illustration; he gives an account of Newton's views on absolute space, time, and motion, and quotes the experiment of the rotating bucket of water, by which absolute rotations are to be discovered. But instead of endeavouring, after the example of many previous writers, to refute in detail the inferences drawn by Newton from this experiment, he contents himself with pointing out the dynamical irrelevance of absolute *translation*, and extending this by means of generalities to absolute *rotation*. The truth seems to be that he, in common with many moderns, is here indulging in an hypothesis of just that kind which Newton endeavoured to avoid: absolute rotation is impossible *a priori*; therefore, if the facts require it, so much the worse for the facts.

There are an unusual number of misprints, and some of them seem to be among the references. In spite of blemishes, however, the book is careful and erudite, and on the historical side very useful.

OUR BOOK SHELF.

The Common Bacterial Infections of the Digestive Tract and the Intoxications arising from Them. By Prof. C. A. Herter. Pp. xii+360. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1907.) Price 6s. 6d. net.

THIS book forms a valuable summary of our knowledge of many of the bacterial infections of the digestive tract, and of the conditions resulting therefrom—valuable alike to the bacteriologist, the chemist, and the clinician. It commences with a review of the normal bacterial flora of the digestive tract, and the significance of the presence of bacteria is first discussed. It is shown that the intestinal bacteria are not required to carry on the ordinary digestive processes and normal nutrition, and the conclusion is formulated that the chief significance of the obligatory intestinal bacteria lies in their potential capacity for checking the development of other types of organisms capable of doing injury.

An interesting section deals with the differences in the bacterial flora of the intestine in nurslings and in bottle-fed infants; the number of bacteria is found to be considerably greater in the latter, and a majority of the organisms present are Gram-negative instead of Gram-positive, as is the case in nurslings. Another feature of interest which is well brought out is that in old age a greater number of putrefactive bacteria are present than in youth. The origin and precise significance of this difference is not yet clear, but it suggests that intestinal infections stand in a causative relation to old age, an hypothesis recently advanced by Metchnikoff, and the author confidently states that the onset of senility may be distinctly accelerated through the development of intestinal infections in which putrefactive anaerobes are prominently represented. A number of details are given for the analysis

of the intestinal contents, and of the significance of the data derived therefrom, together with hints as to treatment.

R. T. HEWLETT.

National Antarctic Expedition, 1901-4. "The Charts of the *Discovery* Antarctic Expedition." By Lieut. G. F. A. Mulock. (London: Royal Geographical Society, 1908.)

THE charts illustrating the work of the National Antarctic Expedition, compiled by Lieut. G. F. A. Mulock, R.N., surveyor and cartographer to the expedition, have now been issued by the Geographical Society in the form of one of its supplementary publications. The series consists of a general chart of the Ross Sea and its coasts, and five on a larger scale showing the detailed geographical work of the expedition. The maps are clearly printed in three colours, the ice-coloured regions being shown in blue, the bare rocks in brown, and routes and altitudes in red; they are folded, and issued in a convenient cloth case, 10 inches high by 6 $\frac{3}{4}$ inches wide. They are accompanied by a short statement of eight pages recording the methods of survey and chief determinations, in which Lieut. Mulock gives credit to his colleagues for their contributions to the work, referring especially to Ferrar's survey of the Ferrar glacier, Bernacchi's determination of the longitude of the winter quarters, Dr. Wilson's sketches of the coast, and Lieut. Skelton's photographs.

The three charts of most interest are those illustrating the Great Ice Barrier and the route of Captain Scott's remarkable sledge journey on to the plateau of southern Victoria Land. Lieut. Mulock retains the name the Great Ice Barrier, and adopts it for the whole ice sheet of which Ross discovered the northern face. Notes on the chart direct attention to the convincing evidence that the edge of this ice sheet is floating, and also of its recession at one place for twenty-three miles since it was discovered by Ross. Confidence in the latter fact is strengthened by Lieut. Mulock's testimony to the remarkable accuracy of Ross's positions. On a second chart the author shows the extension of Ross's Great Ice Barrier to the south, with the route of Scott and his two companions to their farthest south at the entrance to Shackleton Inlet, and of the face of the mountains on the western coast of that part of Antarctica.

Lieut. Mulock is to be congratulated on the skill and care with which he has incorporated all the observations of the expedition into this important series of charts, which are a most valuable addition to Antarctic cartography.

J. W. G.

Archhelenis und Archinotis. Gesammelte Beiträge zur Geschichte der neotropischen Region. By Herman von Ihering. Pp. iv+350. (Leipzig: W. Engelmann, 1907.) Price 6 marks.

Few and far between are the naturalists in South America. But there are exceptions even to this rule. Good work has been done of late years in Buenos Ayres and Pará, and the author of the present volume has not failed to avail himself of the abundant opportunities offered to him for research by the luxuriant fauna and flora of his adopted country. Dr. Herman von Ihering, the energetic director of the Museu Paulista at São Paulo, is well known to us in Europe by his essays on various subjects connected with the distribution of life in different parts of the world, particularly as regards the neotropical region. He has now collected these essays and reprinted them with additions in a uniform shape under the curious title which we give above. "Archhelenis" and "Archinotis" are names invented to designate the two principal continents which the author believes to